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Review of Eupsilobiinae (Coleoptera: Endomychidae) with Descriptions of New Genera and Species from South America

by

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With 59 figures

ABSTRACT

The world genera of Eupsilobiinae (Coleoptera: Endomychidae) are reviewed. Four genera are recognized: *Eidoreus* Sharp is known from widely scattered localities; *Microxenus* Wollaston, formerly placed in the endomychid subfamily Mycetaeinae, is known from South Africa and Mexico; a new genus, *Chileolobius,* is known from Chile and Brazil; and another new genus, *Ibicarella,* is known from Brazil. Five new species of *Chileolobius* are described; *C. cekalovici, C. chilensis,* and *C. notatus* are known only from Chile, while *C. sinimbu* and *C. convexus* are known only from southeastern Brazil. Two new species of *Ibicarella, I. plaumanni* and *I. rotundata,* are described; they are known only from southeastern Brazil.

Keys are included for the genera of Eupsilobiinae and the species of *Chileolobius* and *Ibicarella,* and a lectotype is designated for *Microxenus laticollis.* Taxonomically useful structures are discussed and illustrated, and the taxonomic histories of the previously described genera are discussed.

Twenty-eight characters are used for elucidating the phylogenetic relationships of the four genera. Three trees are presented and their implications for character transformations are discussed. Two of these trees are isomorphic. The generic relationships that we hypothesize are (*Ibicarella* + (*Chileolobius* + (*Microxenus* + *Eidoreus*)).

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INTRODUCTION

The Eupsilobiinae are a poorly understood group that has recently (SEN GUPTA & CROWSON 1973 SASAJI 1986, 1987) received attention due to their inconsistent placement historically within the Clavicornia and their likely importance in understanding the phylogeny of the cerylonid series. This subfamily, as treated in this paper, consists of four genera: *Chileolobius* and *Ibicarella,* both endemic to South America, are new; *Microxenus* Wollaston, known from Mexico and South Africa, was previously placed in the endochymid subfamily Mycetaeinae; and *Eidoreus* Sharp, a widespread group, is the type genus. The most distinctive feature of eupsilobiines is the tentorium (Figs 10, 20, 35) with its elongate, widely divergent anterior arms meeting medially. These beetles are separated from other members of the cerylonid series (CROWSON 1955) by the following combination of characters: antennal club one or two-segmented, maxilla with distinct lacinia, maxillary and labial palps not aciculate, procoxae internally closed and externally widely open, mesocoxae laterally open, hind metacoxae transverse, tarsi 4-4-4 with claws simple, abdomen with five spiracles, first ventrite with femoral lines, and last ventrite simple, not crenulate apically. The placement of Eupsilobiinae within the cerylonid series seems clear, although the precise position of this group is obscure. CROWSON (1981) suggests a close relationship with Coccinellidae, while SASAJI (1986, 1987) emphasizes the distinctive structures of Eupsilobiinae (=Eidoreinae) and places them in the Endomychidae.

Immatures for the subfamily are unknown, and little information about the biology or habitats of adults has been published. Despite several published references to eupsilobiines being collected from or in the vicinity of ant nests, *Eidoreus* and *Microxenus* are not listed as likely or potential associates of ants in three reviews of this subject (KISTNER 1982; WHEELER 1910; WILSON 1971). For example, *Chileolobius convexus,* described below, was taken with *Pachycondyla* Smith in Brazil; *Eidoreus minutus* Sharp was taken twice with ants in Seychelles, once in an ant nest under a stone and once in a decayed log with *Pheidole punctulata* Mayr (ARROW 1922); *Microxenus laticollis* Wollaston was taken from an ant nest in South Africa (WOLLASTON 1861). Clearly, the possible association of some eupsilobiine species with ants needs to be more fully investigated. Most other collecting records for eupsilobiines are from mixed forest litter or vegetative debris.

Another interesting aspect of these beetles is the peculiar distribution of *Eidoreus.* Most published reports or data from specimens that we have seen are from widely scattered islands, with specimens from mainland localities rare. For example, CASEY (1895) reported *Eidoreus politus* (Casey) from a sandy islet near Key West, Florida, SHARP (1885) reported *E. minutus* from Hawaii, and ARROW (1922, 1927) subsequently reported this species from the Seychelles and the Samoan Islands. We have seen additional material of *Eidoreus* from Cuba, the Virgin Islands, Guadeloupe, the Galopagos, the Mascarene Islands, Seychelles, Sri Lanka, Fiji, French Polynesia, and the Solomon Islands. In addition, SASAJI (1986) reports *Eidoreus* from Japan. Conversely, SEN GUPTA and CROWSON (1973) studied specimens from Mexico and Belize.

CASEY (1895) established the tribe Eupsilobiini for *Eupsilobius politus* Casey and placed this species in the murmidiine Cucujidae. Subsequently, SEN GUPTA and CROWSON (1973) suggested that this genus was sufficiently distinct to be made the type of a separate subfamily of Endomychidae. This suggestion was followed by STROHECKER (1986), LAWRENCE (in press), and SASAJI (1986, 1987), although Sasaji used the name Eidoreinae which is a junior synonym.

The first genus described for this subfamily was *Eidoreus* which was established by SHARP (1885) for a new species of Erotylidae, *E. minutus,* from Hawaii. KOLBE (1910) established a new genus and species, *Pseudalexia sechellarum,* for a sphaerosomatine Endomychidae, but this species was subsequently synonymized with *Eidoreus minutus* by ARROW (1922). Other workers were perplexed by this genus and were uncertain where it should be placed in Coleoptera. KUHNT (1911) placed it in dacnine Erotylidae, ARROW (1925) in euxestine Erotylidae, VAN EMDEN (1928) near primitive Coccinellidae, HETSCHKO (1930) and ARNETT (1960) in murmidiine Colydiidae, SEN GUPTA and CROWSON (1973) synonymized *Eupsilobius* with *Eidoreus* and placed it in Endomychidae, STROHECKER (1986) listed it as a eupsilobiine Endomychidae but expressed considerable reservation, SASAJI (1986) established a new subfamily of Endomychidae, the Eidoreinae, for *Eidoreus* unaware of Casey's name Eupsilobiini, and this was followed in another paper (SASAJI 1987).

WOLLASTON (1861) established *Microxenus* for a new species, *M. laticollis* from South Africa and placed the genus in Mycetophagidae near *Mycetaea* Stephens. Subsequently, CSIKI (1905, 1910) placed *Microxenus* in the mycetaeine Endomychidae near *Exysma* Gorham. STROHECKER (1953) essentially followed this arrangement.

MUSEUM ACRONYMS

The following acronyms indicate depositories for specimens used in this study:

AMNH	American Museum of Natural History, New York
ANIC	Australian National Insect Collection, Canberra City
BMNH	British Museum (Natural History), London
BPBM	Bishop Museum, Honolulu
CASC	California Academy of Sciences, San Francisco
CNCI	Canadian National Collection of Insects, Ottawa
FMNH	Field Museum of Natural History, Chicago
JPCC	J. Pakaluk Collection
MAIC	M. A. Ivie Collection
MHNG	Muséum d'Histoire naturelle, Genève
SEMC	Snow Entomological Museum, University of Kansas, Lawrence
USNM	National Museum of Natural History, Washington
ZMPA	Instytut Zoologii, Polska Akademia Nauk, Warszawa

Eupsilobiinae Casey

Eupsilobiini Casey, 1895: 454.
Euspilobiini, Sasaji, 1986: 229 (error).
Eidoreinae Sasaji, 1986: 235 (syn. n.).

This subfamily appears to be a monophyletic group, although virtually all of the characters that unite these genera, such as the recurved mesal arms of the tormae, distinctive tentorium, and well-developed internal apodemes on the ventrites, requires dissection and clearing of cuticular structures for proper examination.

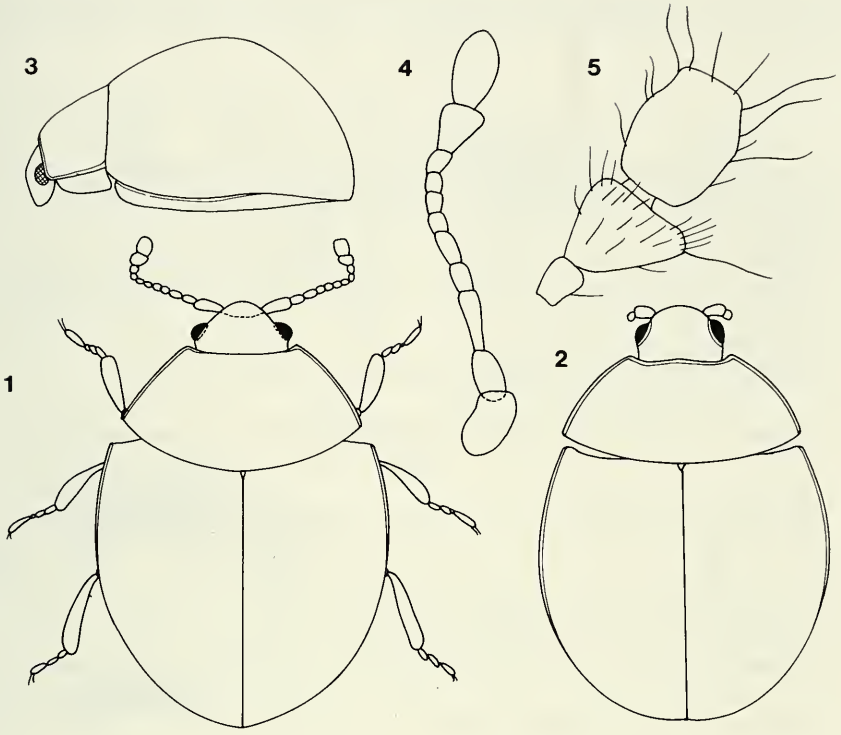
Key to Genera of Eupsilobiinae

1. Fronto-clypeal suture absent; antennal grooves long, extending well-beyond eyes (Fig. 35); prosternal process narrow, acute or rounded, never expanded apically (Fig. 36); elytra with humeral regions concave to receive hind angles of pronotum; abdomen with five ventrites ..... *Chileolobius* gen. n.
— Fronto-clypeal suture present; antennal grooves short, ending at about middle of eyes (Fig. 20); prosternal process wide, expanded apically (Fig. 13); elytra with humeral regions unmodified; abdomen with six ventrites ..... 2.
2. Body less convex (greatest depth/elytral length less than 0.50), ovate to obovate; antenna 10-segmented; metasternum with femoral lines; aedeagus with median lobe highly coiled ..... 3.
— Body highly convex (greatest depth/elytral length greater than 0.60), subhemisphaerical; antenna 11-segmented; metasternum without femoral lines; aedeagus with median lobe curved, but not highly coiled ..... *Ibicarella* gen. n.
3. Pronotum smooth, without sulci; hypomeron modified to receive antenna; mesosternum modified, with anterior projection; scutellum normal, triangular, distinctly visible at 25× magnification ..... *Eidoreus* Sharp
— Pronotum with distinct sulci; hypomeron unmodified for receiving antenna; mesosternum without anterior projection; scutellum minute, transverse, barely visible at 50× magnification ..... *Microxenus* Wollaston

Chileolobius gen. n.

Species in this genus are easily recognized by the lack of a fronto-clypeal suture, concave elytral humeri to receive the produced hind angles of the pronotum, five ventrites, and other characters included in the key. This genus is presently known only from a few scattered localities in northern Chile and southeastern Brazil; assiduous collecting in neighboring regions will likely produce many additional specimens and species. The Chilean species are smaller and flatter; these are superficially most similar to *Eidoreus,* but they are easily separated by the characters listed above.

Description. Length 1.20-1.95 mm. Body (Figs 32, 34, 38) ovate to round, weakly to strongly convex, pubescence short to absent. Head transverse. Eye extremely reduced, coarsely faceted, in distinct dorsal groove (as in *Displotera* Reitter). Fronto-clypeal suture absent. Antenna 10- or 11-segmented with 1- or 2-segmented club; antennal groove (Fig. 35) long, extending well beyond eye. Labrum (Fig. 42) transverse, weakly sclerotized, almost completely exposed, with anterior edge truncate to weakly emarginate medially; tormae with mesal arms recurved, directed anteriorly; labral rods absent. Mandible (Fig. 40) bifid apically, with prominent subapical tooth; mola reduced, transversely ridged; prostheca fringed. Maxilla (Fig. 41) with 4-segmented palp; galea broad, with apical setae; lacinia with apical setae. Labium with 3-segmented palp; mentum trapezoidal, widest at middle. Gular sutures indistinct. Tentorium (Fig. 35) with anterior and posterior arms fused, posterior transverse bridge straight. Pronotum (Figs 32, 34, 38) transverse, with anterior edge emarginate, posterior edge evenly rounded, usually emarginate, lateral edge margined for anterior 2/3, with hind angles produced, covering base of elytra. Prosternum (Fig. 36) prominent anteromedially, covering gular region of head; hypomeron concave; antennal groove extremely short, on anterolateral margin; intercoxal process short, rounded or acute apically, never extending beyond middle of coxa. Procoxa rounded, contiguous medially, with narrow internal extension,



FIGS 1-5.

Ibicarella spp. 1, 5 *I. plaumanni*; 2-4 *I. rotundata.* 1, 2 dorsal outline; 3, lateral outline; 4, antenna; 5, antennal club.

its cavity internally closed, externally widely open. Mesosternum extremely prominent medially (Fig. 37), covering procoxae, subequal in width to mesocoxa, junction of meso- and metasternum straight-line type, without internal knobs. Mesocoxa round, trochantin concealed, its cavity laterally open. Metasternum 0.85× length of first ventrite, with femoral lines, postcoxal pits absent. Metacoxa round, widely separated. Leg (Fig. 43) with trochanterofemoral attachment oblique, heteromeroid; femur swollen, excavate to receive retracted tibia; tibia without apical spurs; tarsi (Fig. 44) 4-4-4 in both sexes, segments 1 and 2 partially fused, 2 and 3 weakly lobed; claws simple, empodium absent. Scutellum minute, triangular. Elytra partially fused along suture, with humeral region partially concave to receive pronotal hind angles, punctation irregular; epipleuron incomplete. Wing absent. Abdomen (Fig. 37) with 5 ventrites; 1 subequal in length to 2-4, with broad, truncate intercoxal process, femoral lines long, incomplete; 2-4 subequal in length; 2-5 with internal, anterolateral apodemes. Aedeagus (Figs 48-54) with short, subcylindrical tegmen, tegminal strut absent; median lobe about 0.8× as long as abdomen, about 1.5× longer than tegmen, with T-shaped capsule.

Type species. *Chileolobius notatus* sp. n.

Etymology. The generic name is derived from the name of the country "Chile" and the Latin lobus, meaning projection, referring to the acute prosternal process; the gender is masculine.

Key to species of *Chileolobius*

1. Length 1.75-1.95 mm. Prosternal process wide, rounded apically. Vestiture of dorsum distinctly visible at 10× magnification, dense; known distribution Brazil ..... 2.
— Length 1.20-1.40 mm; prosternal process narrow, subacuminate apically; vestiture of dorsum barely visible at 10× magnification or indistinct; known distribution Chile ..... 3.
2. More convex, greatest depth/elytral length about 0.50; clypeus rounded anteriorly (Fig. 30); body rounder, about 1.35× longer than wide ..... *convexus* sp. n.
— Less convex, greatest depth/elytral length about 0.37; clypeus almost truncate anteriorly (Fig. 33); body more elongate, about 1.50× longer than wide ..... *sinimbu* sp. n.
3. Antennal club 1-segmented; body elongate, about 1.80× longer than wide; elytra about 2.90-3.00× longer than pronotum; body reddish brown ..... *chilensis* sp. n.
— Antennal club 2-segmented; body ovate, about 1.50-1.63× longer than wide; elytra about 3.60-3.90× longer than pronotum; body dark brown to black . 4.
4. Elytra and venter with pale maculae (Fig. 38); aedeagus as in Figures 48 & 49 ..... *notatus* sp. n.
— Elytra and venter unicolorous; aedeagus as in Figure 47 ..... *cekalovici* sp. n.

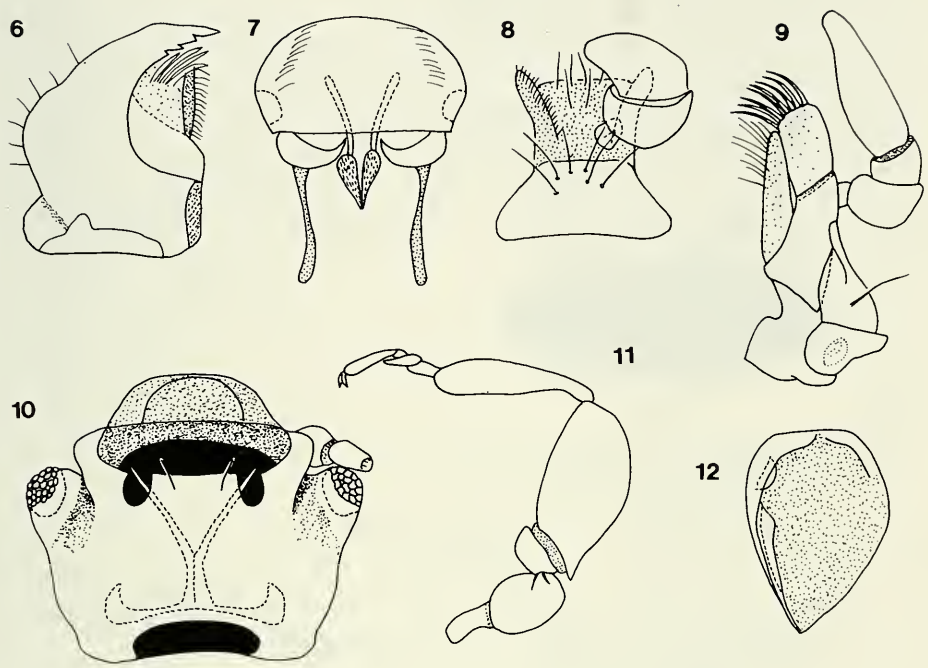
Chileolobius cekalovici sp. n.
(Figs 47, 51-54)

This is the smallest species of *Chileolobius* and is recognized by its size, unicolorous elytra, and slightly flattened body.

Description. Length 1.2 mm. Body ovate, 1.70× longer than wide, moderately convex, greatest depth/elytral length 0.33, black; vestiture of extremely short hairs, barely visible at 80× magnification; dorsum almost glabrous. Antenna as in Figure 47. Clypeus narrow, anterior edge truncate. Frons and vertex punctate, punctures separated by their diameters, cuticle between punctures smooth, shiny. Pronotum 0.34× longer than wide; lateral margin visible from above in anterior 1/2; posterior edge widely emarginate medially; disc punctate, punctures sparser than on vertex, cuticle between punctures smooth, shiny. Elytra 1.15× longer than wide, 3.61× longer than pronotum, widest at basal 1/5; lateral edges arcuate, convergent anteriorly, margin almost entirely visible from above; punctures on disc similar in size and density to pronotal punctures. Aedeagus as in Figures 51-54.

Type. Holotype (male): Chile. Concepcion Prov.: Hualpen, December 1971, T. Cekalovic (MHNG).

Etymology. This species is named for Thomas Cekalovic who collected the only known specimen.



FIGS 6-12.

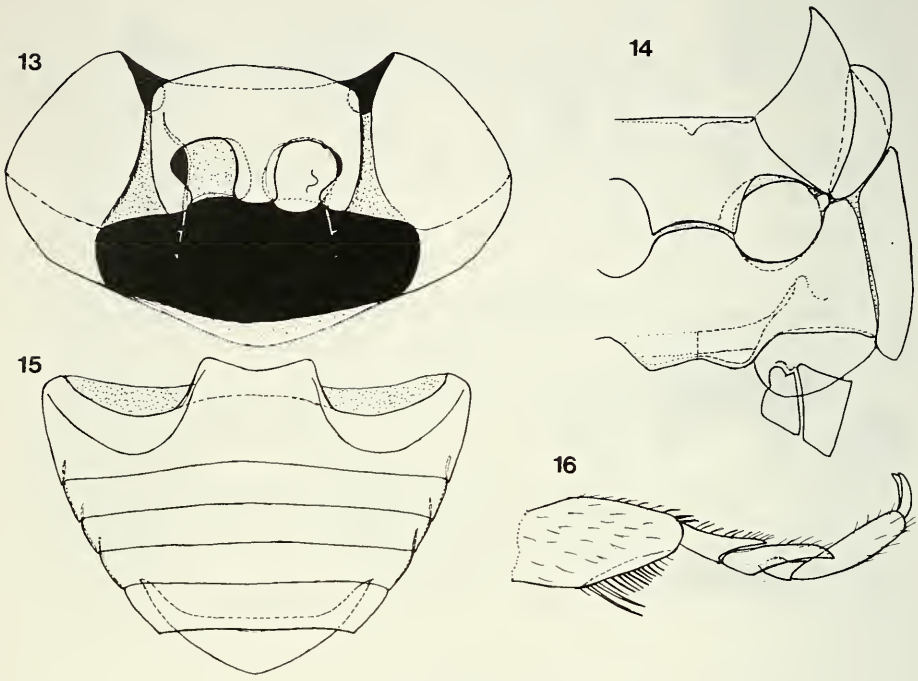
Ibicarella plaumanni. 6, mandible, ventral; 7, labrum, dorsal; 8, labium, ventral; 9, left maxilla, ventral; 10, head, ventral; 11, foreleg; 12, elytron, ventral.

Chileolobius chilensis sp. n.
(Figs 35-37, 40-45, 50, 56)

The relatively large size of this species and its unicolorous elytra separate it from other Chilean species. It is the only species with a ten-segmented antenna with a one-segmented club.

Description. Length 1.4 mm. Body ovate, 1.83× longer than wide, moderately convex, greatest depth/elytral length 0.31, reddish brown to brown; vestiture variable, always sparse, short hairs always present, some hairs 0.5-0.6× length of antennal segment 2, distinct at 20× magnification; dorsum finely punctate. Antenna (Fig. 56) 10-segmented, with 1-segmented club. Clypeus with anterior edge truncate. Frons and vertex punctate, punctures separated by their diameters, cuticle between punctures smooth, shiny. Pronotum (Fig. 36) 0.42× longer than wide; lateral margin narrow, visible from above in anterior 2/3; posterior edge almost truncate, not emarginate medially; disc punctate, punctures finer than on vertex, separated by 1.5-2.5× their diameters, cuticle between punctures smooth, shiny. Elytra 1.15× longer than wide, 2.94× longer than

pronotum, widest at anterior 1/3; lateral edges arcuate, convergent anteriorly, margin almost entirely visible from above; punctures on disc similar in size and density to pronotal punctures. Aedeagus as in Figure 50.



Figs 13-16.

Ibicarella plaumanni. 13, prothorax, ventral; 14, pterothorax (part), ventral; 15, abdomen, ventral; 16, apex of protibia and tarsus.

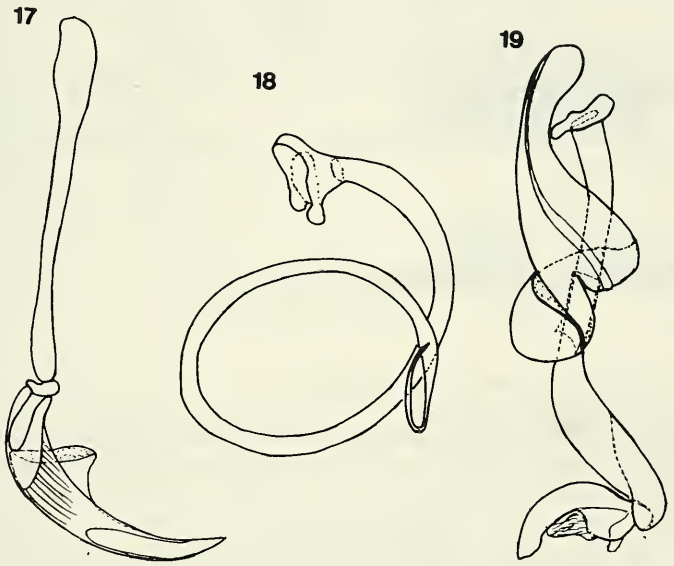
Types. Holotype (male): Chile. Coquimbo Prov.: 10 km W Canela Baja, 30 September 1967, under stones, L. and C. W. O'Brien (ANIC). Paratypes: Chile. Santiago Prov.: Cerro San Cristobal, August 1946, L. Pena (ANIC); Valparaiso Prov., Valparaiso, Rivera (ANIC); Prov. unknown: El Cobre, Quebrada el Soldado, 15 July 1961, L. Smith (ZMPA).

Etymology. The name *chilensis* is based upon the only country where this species has been collected.

Chileolobius convexus sp. n.
(Figs 30-32)

This species is easily distinguished from most other species by its large size. It differs from *C. sinimbu* by the key characters and its elytral pubescence which is longer and denser on *C. convexus*. A specimen deposited in the Field Museum of Natural History was taken with *Pachycondyla* (Formicidae).

Description. Length 1.75-1.95 mm. Body (Fig. 32) ovate, almost rounded, 1.35× longer than wide, convex (Fig. 31), greatest depth/elytral length 0.50, brown; vestiture of moderately dense, yellow hairs, subequal in length to antennal segment 2, distinct at 10× magnification; dorsum shiny. Clypeus (Fig. 30) with anterior edge rounded. Frons and vertex punctate, setose, punctures separated by their diameters, cuticle between punctures densely reticulate, feebly shiny. Pronotum 0.32× longer than wide; lateral margin almost invisible from above; posterior edge widely emarginate medially; disc punctate, punctures similar in size and density to those on vertex, cuticle between punctures smooth, shiny. Elytra 1.04× longer than wide, 3.50× longer than pronotum, widest at anterior 1/5; lateral edges arcuate, convergent anteriorly, margin extremely narrow, invisible from above; punctures on disc irregular, similar in size and density to pronotal punctures, cuticle between punctures smooth, shiny.



FIGS 17-19.

17, 18 *Microxenus* sp. aedeagus; 17, tegmen, ventral; 18, median lobe. 19, *Ibicarella plaumanni,* aedeagus, dorsal.

Types. Holotype (female): BRAZIL. Santa Catarina: Nova Teutonia, July 1957, forest floor litter, F. Plaumann (ANIC). Paratypes: Four with same data as holotype, except one collected 17 August 1944 with *Pachycondyla* and three taken from Seara in May 1958 (FMNH, JPCC).

Etymology. The Latin name *convexus* refers to this species highly convex dorsum.

Chileolobius notatus sp. n.
(Figs 38, 39, 46, 48, 49, 55)

The relatively small dark brown body with numerous, tiny brown elytral maculae distinguishes this species from others in the genus.

Description. Length 1.25 mm. Body (Fig. 38) ovate, 1.60× longer than wide, moderately convex (Fig. 39), greatest depth/elytral length 0.35, dark brown, except head, lateral margins of pronotum, and small, irregular spots on elytra that are brown; vestiture absent; dorsum punctate. Antenna as in Figure 55. Clypeus prominent, anterior edge truncate. Frons and vertex sparsely punctate, cuticle between punctures weakly reticulate, shiny. Pronotum 0.32× longer than wide; lateral margin narrow, barely visible from above in anterior 1/2; posterior edge deeply, widely emarginate medially; disc punctate, their diameters 1.40× larger than punctures on frons, separated by 2.0-4.0× their diameters, cuticle between punctures almost smooth, shiny. Elytra 1.13× longer than wide, 3.84× longer than pronotum, widest at anterior 1/4; lateral edges arcuate, convergent anteriorly (Fig. 38), margin relatively broad, basal 3/4 visible from above; punctures on disc extremely fine, sparse, cuticle between punctures shiny. Aedeagus as in Figures 48 & 49, median lobe extremely thin, long, and coiled.

Type. Holotype (male): CHILE. Concepcion Prov.: 8 km S Florida, 6 September 1973, T. Cekalovic (ANIC).

Etymology. The name *notatus* is from the Latin nota, meaning marked, referring to the spots on the dorsum.

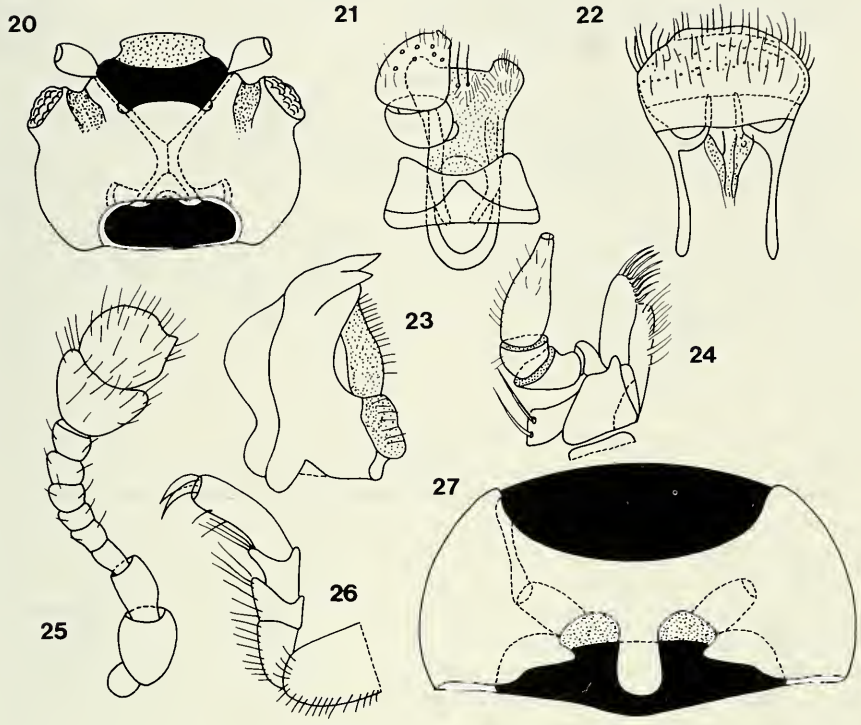
Chileolobius sinimbu sp. n.
(Figs 33, 34)

This species is most similar to *C. convexus* but is easily separated by the key characters and others discussed earlier.

Description. Length 1.91 mm. Body (Fig. 34) slightly elongate, 1.50× longer than wide, moderately convex, greatest depth/elytral length 0.37, black; vestiture sparse, pale, hairs subequal in length to antennal segment 2, barely visible at 10× magnification; dorsum shiny. Antenna as in *Chileolobius convexus,* with large, 2-segmented club. Clypeus (Fig. 33) with anterior edge almost truncate. Frons and vertex punctate, punctures extremely fine, sparse, cuticle between punctures densely reticulate, shiny. Pronotum 0.31× longer than wide; lateral margin narrow, visible from above in anterior 1/3; posterior edge widely emarginate medially; disc with punctures, vestiture, and surface sculpture similar to vertex. Elytra 1.10× longer than wide, 3.85× longer than pronotum, widest at anterior 1/3; lateral edges arcuate, convergent anteriorly, margin extremely narrow, almost entirely visible from above; punctures on disc irregular, sparse, slightly coarser than pronotal punctures.

Type. Holotype (female): BRAZIL. Rio Grande do Sul: Sinimbu, 29.30'×52.30', 200 m, September 1960, F. Plaumann (ANIC).

Etymology. The name of the species is taken from the type locality of Sinimbu, Brazil; it is a noun in apposition.



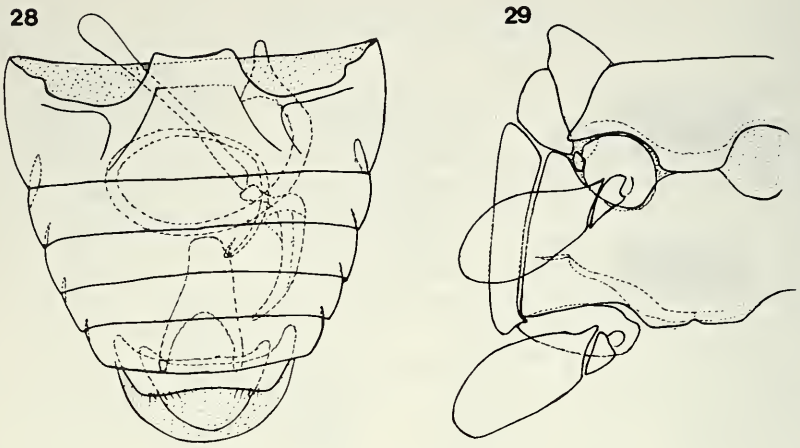
FIGS 20-27.

Microxenus sp. (from Mexico). 20, head, ventral; 21, labium, ventral; 22, labrum, dorsal; 23, mandible, dorsal; 24, maxilla, ventral; 25, antenna; 26, apex of protibia and tarsus; 27, prothorax, ventral.

Eidoreus Sharp

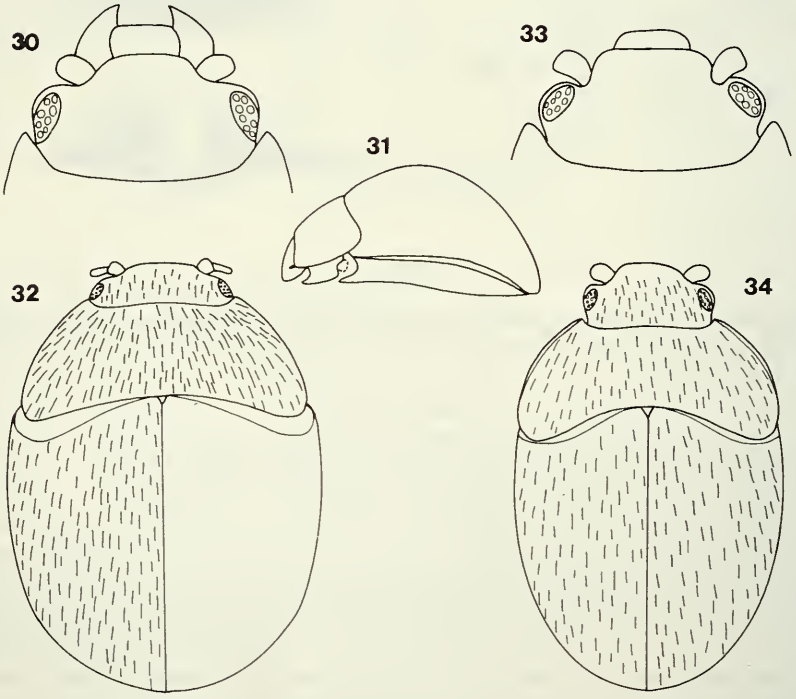
Eidoreus Sharp, 1885: 146. Type species, by monotypy, *E, minutus* Sharp.
Eupsilobius Casey, 1895: 454. Type species, by monotypy, *E. politus* Casey.
Pseudalexia Kolbe, 1910: 34. Type species, by monotypy, *P. sechellarum.*
Euspilobius, Sasaji, 1986: 230 (error).

Within Eupsilobiinae species of *Eidoreus* are superficially most similar to the Chilean species of *Chileolobius. Eidoreus* can be separated from these other genera, however, by their distinct fronto-clypeal suture, ten-segmented antenna with a two-segmented club, lack of pronotal sulci, modified mesosternal process, and well-developed femoral lines on the metasternum and first ventrite. Outside this subfamily they resemble *Coluocera* Motschulsky but are easily separated by a number of characters, including a distinctly two-segmented antennal club, presence of femoral lines, and six ventrites. SASAJI (1986) presented a detailed redescription of this genus with illustrations of important structural features.



FIGS 28, 29.

Microxenus sp. (from Mexico). 28, abdomen, ventral; 29, pterothorax (part), ventral.



FIGS 30-34.

Chileolobius spp. 30-32, *C. convexus*, 33, 34 *C. sinimbu*. 30, 33 head, dorsal outline; 31, lateral outline; 32, 34 dorsal outline.

Material examined. Thirty-nine specimens from Fiji, French Polynesia (Tubuai Islands), the Solomon Islands (Guadalcanal), United States (Southern Florida), Cuba, Guadeloupe, Reunion, and Ecuador (Galopagos Islands) (BMNH, BPBM, CNCI, JPCC, MHNG, SEMC, USNM).

Ibicarella gen. n.

These beetles superficially resemble some Endomychidae (such as *Rhymbomicrus* Casey) and certain scymnine Coccinellidae. They are dark-colored with a highly convex, subhemisphaerical body. They can be separated from other genera of Eupsilobiinae by the characters used in the key.

Description. Length 1.15-1.70 mm. Body (Figs 1, 2) broadly rounded, subglobose, shiny. Head (Fig. 10) transverse. Eye reduced, coarsely faceted. Fronto-clypeal suture present, arcuate. Antenna (Fig. 4) 11-segmented with loose, 2-segmented club, segment 10 weakly asymmetrical; antennal groove (Fig. 10) moderately long, apex extending to about middle of eye. Labrum (Fig. 7) transverse, sclerotized, almost completely exposed, with anterior margin broadly rounded; tormae with mesal arms recurved, directed anteriorly; labral rods narrow and divergent anteriorly. Mandible (Fig. 6) bifid apically; mola well-developed, transversely ridged; prostheca fringed. Maxilla (Fig. 9) with 4-segmented palp; galea blunt; lacinia without apical or mesal spines. Labium (Fig. 8) with 3-segmented palp; mentum trapezoidal; ligula slightly expanded apically. Gular sutures indistinct. Tentorium (Fig. 10) with anterior and posterior arms broadly fused at base to posterior transverse bridge. Pronotum (Fig. 13) transverse, with anterior edge emarginate, posterior edge evenly rounded, without medial lobe, lateral margin complete. Prosternum prominent anteromedially; hypomeron concave; antennal groove narrow, deep. Procoxa rounded, with narrow internal extension, its cavity internally closed, externally widely open. Mesosternum subequal in width to mesocoxa, junction of meso- and metasternum straight-line type, without internal knobs. Mesocoxa round, trochantin partially exposed, its cavity laterally open. Metasternum subequal in length to first ventrite, without femoral lines or postcoxal pits. Metacoxa transverse, widely separated. Leg (Fig. 11) with trochanterofemoral attachment oblique, subheteromeroid; femur swollen in middle, tibia without apical spurs; tarsi 4-4-4 in both sexes, segments 1 and 2 lobed; claws simple, empodium absent. Scutellum minute, triangular. Elytral punctation irregular; epipleuron (Fig. 12) incomplete. Wing reduced or absent, if present subcubital fleck present, undivided. Abdomen (Fig. 15) with 6 ventrites; 1 slightly longer than 2, with broad, truncate intercoxal process, femoral lines complete; 2-4 subequal in length, with internal, anterolateral apodemes; 5 without internal apodemes; 6 partially exposed, flexible. Aedeagus (Fig. 19) with short, subcylindrical tegmen, tegminal strut absent; median lobe about 0.8× as long as abdomen, about 1.5× longer than tegmen, with T-shaped capsule.

Type species. *Ibicarella plaumanni* sp. n.

Etymology. The generic name is derived from the type locality for one of its species; the gender is feminine.

KEY TO SPECIES OF *IBICARELLA*

1. Length 1.70 mm. Elytral margins visible from above for basal 1/2 (Fig. 1). Anterior edge of pronotum distinctly margined its entire width ..... *rotundata* sp. n.
— Length 1.15 mm. Elytral margins visible from above for basal 2/3 (Fig. 2). Anterior edge of pronotum distinctly margined medially, lines effaced laterally ..... *plaumanni* sp. n.

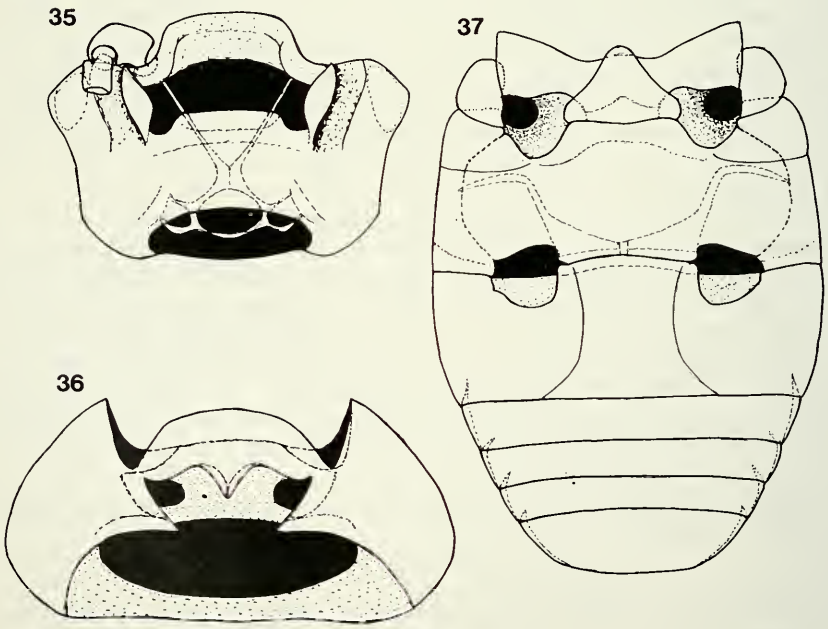
Ibicarella plaumanni sp. n.
(Figs 1, 5, 6-12, 13-16, 19)

This is one of the smallest species of Eupsilobiinae. Its size, slightly less convex body, and other characters listed in the key separate it from *I. rotundata.*

Description. Length 1.15 mm. Body (Fig. 1) 1.23× longer than wide, highly convex, greatest depth/elytral length 0.61, dark brown to almost black; vestiture of extremely fine, appressed dark hairs, barely visible at 80× magnification, sometimes hairs virtually absent; dorsum shiny. Antenna as in Figure 5. Eye lightly pigmented, with about 30 facets. Supraocular carina weak, not well-developed. Frons and vertex finely punctate. Pronotum 0.43× longer than wide, widest at hind angles; anterior edge distinctly margined laterally, effaced medially; posterior edge unmargined; disc extremely convex, punctation irregular, punctures finer than on vertex, cuticle between punctures smooth, shiny. Elytra 2.75× longer than pronotum; margins broader than pronotal margins, visible from above for at least basal 2/3, sometimes for its entire length, disc weakly punctate, almost smooth. Aedeagus as in Figure 19.

Types. Holotype (male): Brazil. Santa Catarina: Nova Teutonia, 300-500 m, 27.11'×52.28', July 1977, F. Plaumann (MHNG). Paratypes: Six with same locality and collector, but July 1969, October 1972, and December 1972 (AMNH, JPCC, MHNG, ZMPA).

Etymology. This species is named for Fritz Plaumann who collected all known specimens.



Figs 35-37.

Chileolobius chilensis. 35, head, ventral; 36, prothorax, ventral; 37, pterothorax and abdomen, ventral.

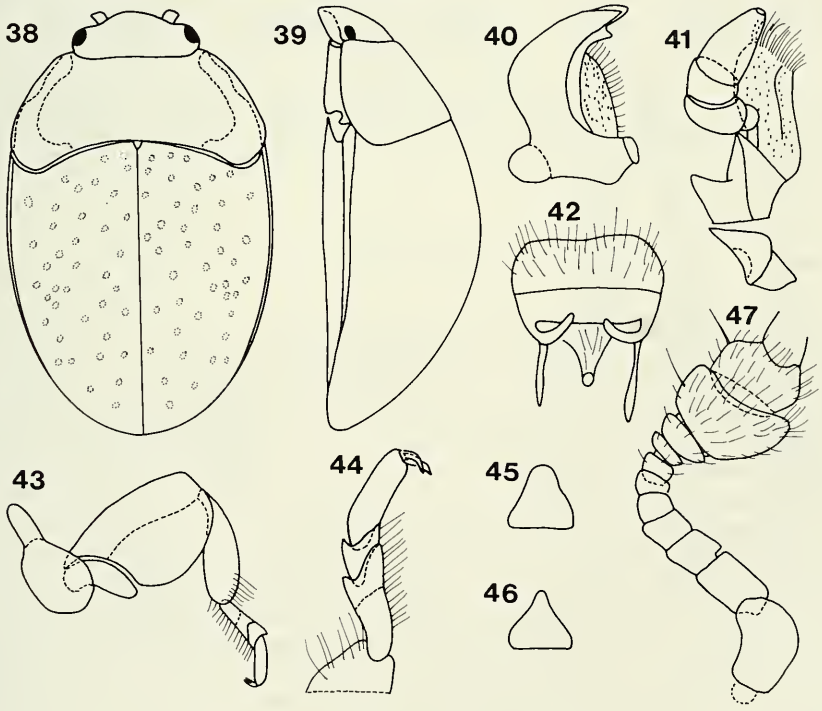
Ibicarella rotundata sp. n.
(Figs 2-4)

This is the most convex and one of the largest species of Eupsilobiinae. The characters discussed under *I. plaumanni* separate the two species of this genus.

Description. Length 1.70 mm. Body (Fig. 2) 1.36× longer than wide, extremely convex, greatest depth/elytral length 0.73, black; vestiture of extremely short, appressed dark hairs, barely visible at 60× magnification, sometimes hairs virtually absent; dorsum shiny. Antenna as in Figure 4. Eye lightly pigmented, with about 25-30 facets. Supraocular carina distinct. Frons and vertex finely punctate. Pronotum 0.50× longer than wide, widest at hind angles; anterior edge distinctly margined for its entire width; posterior edge finely margined medially; disc convex (Fig. 3), punctation dense, punctures coarser, denser than on vertex. Elytra 2.30× longer than pronotum; margins slightly broader than pronotal margins, visible from above for basal 1/2; punctate, punctures finer than on pronotum.

Types. Holotype (female): BRAZIL. Santa Catarina: Ibicare, 600 m, 27.09'×51.18', September 1960, F. Plaumann (ANIC). Paratypes: Two with same data as holotype (ANIC, ZMPA).

Etymology. The name *rotundata* is from the Latin rotundus, meaning round, referring to the dorsal outline in lateral view.



FIGS 38-47.

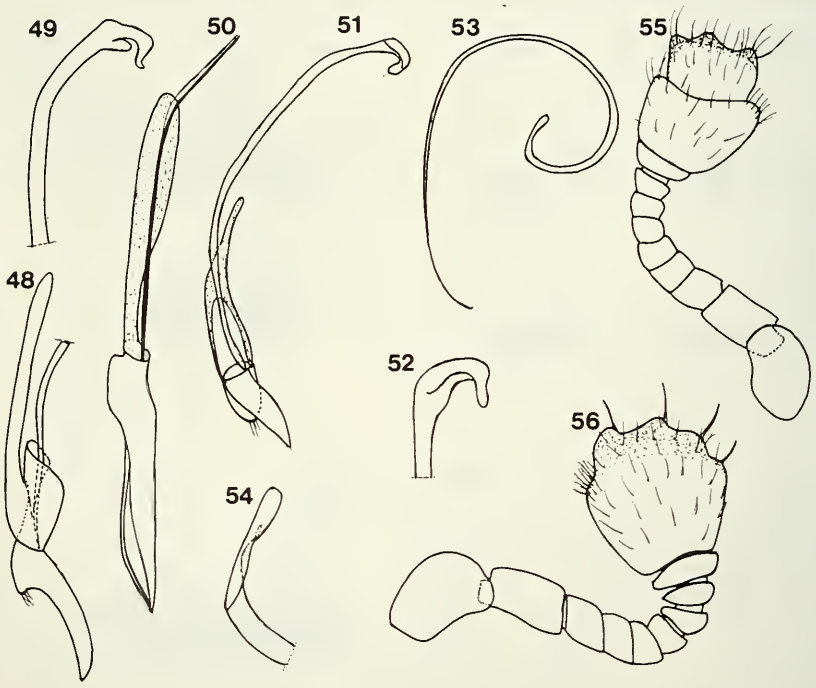
Chileolobius spp. 38, 39, 46, *C. notatus,* 40-45, *C. chilensis,* 47, *C. cekalovici.* 38, dorsal outline; 39, lateral outline; 40, mandible, dorsal; 41, maxilla, ventral; 42, labrum, dorsal; 43, foreleg; 44, protarsus; 45, 46, mesosternal process; 47, antenna.

Microxenus Wollaston
(Figs 17, 18, 20-29)

Microxenus Wollaston, 1861: 139. Type species, by monotypy, *M. laticollis* Wollaston.

This genus appears to be the sister-group to *Eidoreus*. It is unique among Eupsilobiinae for its pronotal sulci, although these can be reduced and difficult to see in some specimens. The characters in the key and the distinctive V-shaped femoral lines on the first ventrite separates this genus from all others.

Description. Length 1.25-1.40 mm. Body elongate-oval, moderately convex, vestiture of very fine, appressed hairs. Head (Fig. 20) transverse. Eye moderately large, coarsely faceted. Fronto-clypeal suture present, weakly arcuate. Antenna (Fig. 25) 10-segmented with 2-segmented club; antennal groove (Fig. 20) short, weakly impressed, apex extending to about posterior edge of eye. Labrum (Fig. 22) transverse, sclerotized, completely exposed, with anterior margin broadly rounded; tormae with mesal arms recurved, directed anteriorly; labral rods short, subparallel. Mandible (Fig. 23) bifid apically; mola well-developed, transversely ridged; prostheca fringed. Maxilla (Fig. 24) with 4-segmented palp; galea blunt; lacinia without apical or mesal spines. Labium (Fig. 21) with



Figs 48-56.

Chileolobius spp. 48, 49, 55, *C. notatus,* 50, 56, *C. chilensis,* 51-54, *C. cekalovici.* 48, 50, tegmen, ventral; 49, 52, apex of tegminal strut; 53, median lobe, ventral; 54, basal piece of median lobe; 55, 56, antenna.

3-segmented palp; mentum trapezoidal, with distinctly raised triangular area medially; ligula slightly expanded apically. Gular sutures indistinct. Tentorium (Fig. 20) with anterior arms fused, with lyriform posterior transverse bridge. Pronotum (Fig. 27) transverse, with anterior edge entire, posterior edge with medial lobe, lateral margin complete, basal transverse impression and short, lateral sulci distinct to barely visible, without foveae. Prosternum with intercoxal process about 0.4× diameter of procoxa, weakly carinate and extremely weakly divergent apically, with apex evenly rounded; hypomeron concave, without antennal grooves. Procoxa rounded, with long, narrow internal extension, its cavity internally closed, externally widely open. Mesosternum subequal in width to mesocoxa, junction of meso- and metasternum straight-line type, without internal knobs. Mesocoxa round, trochantin exposed, its cavity laterally open. Metasternum about 1.4× longer than first ventrite, femoral lines complete, postcoxal pits absent. Metacoxa transverse, widely separated. Leg with trochanterofemoral attachment oblique (Fig. 29), subheteromeroid, trochanter long; femur swollen; tibia without apical spurs; tarsi (Fig. 26) 4-4-4 in both sexes, segments 1 and 2 partially fused, 2 and 3 slightly lobed; claws simple, empodium absent. Scutellum minute, transverse. Elytral punctation irregular; epipleuron incomplete. Wing with single, reduced anal vein, subcubital fleck present, undivided. Abdomen (Fig. 28) with 6 ventrites; 1 much longer than 2, with broad intercoxal process, femoral lines incomplete; 2-5 subequal in length, with internal, anterolateral apodemes; 6 partially exposed, flexible. Aedeagus (Figs 17, 18, 28) with short, cylindrical tegmen, tegminal strut long, articulated, with parameres reduced; median lobe extremely long with T-shaped capsule.

Types. Lectotype (here designated) of *Microxenus laticollis:* SOUTH AFRICA. Cape Prov.: Cape Town, Mr. Bewicke (BMNH). Paralectotypes not examined.

Other material. Twenty-nine specimens from Mexico and South Africa (BMNH, CASC, JPCC, MAIC, ZMPA).

PHYLOGENY

The precise position of Eupsilobiinae within the cerylonid series of Clavicornia is presently unknown. Based upon preliminary data and analyses, the eupsilobiines appear to belong to a monophyletic subgroup characterized by five abdominal spiracles in adults. Other cerylonid series taxa with this apomorphy are murmidiine, ostomopsine, and cerylonine Cerylonidae, Discolomidae, Coccinellidae, and other Endomychidae. Further resolution of the relationships among these taxa will ultimately depend upon understanding the ground plans for these suprageneric taxa, as many of these groups have both states of important characters present or the polarity of a character is uncertain.

For the phylogenies presented below (Figs 57-59), the numbers on the trees, and in the discussions of these trees, refer to the following characters, with the apomorphic condition listed first and the plesiomorphic condition following in brackets. Characters were polarized using outgroup comparisons of groups presumed to be closely related to Eupsilobiinae, such as some Cerylonidae and primitive Endomychidae. Often, however, both states of a character occur in the outgroup, so the polarity is determined by comparing the distribution of these characters among other primitive members of the cerylonid series. Additional hypotheses of relationships (Figs 58 & 59) are presented using the Byturidae-Biphyllidae lineage as the outgroup. These analyses, and their implications, will be discussed later.

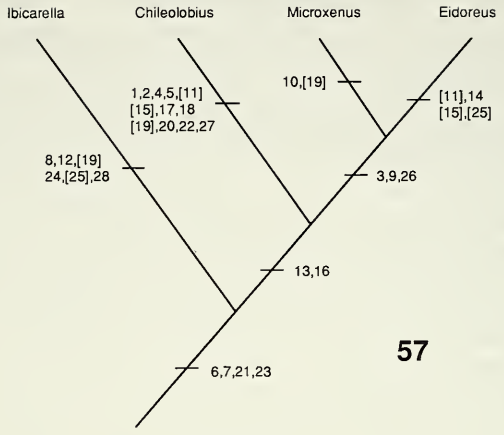


FIG. 57.

Proposed phylogeny of eupsilobiine genera. Numbers refer to characters listed in text, and apparent homoplasies are in brackets.

(1) Frontal-clypeal suture: absent [present]. Although the suture is absent in the Biphyllidae and Byturidae, we prefer to interpret the absence of the suture here as derived. Within the cerylonid series the suture is present in all other groups except highly derived forms, such as Coccinellidae, Corylophidae, and cerylonine Cerylonidae.

(2) Antennal groove: long [short]. The presence of distinct, subocular antennal grooves is common throughout the Clavicornia. Short grooves extend to about the middle of the eye, whereas long grooves extend beyond the posterior edge of the eye. Short grooves occur in Byphyllidae and a variety of groups within the cerylonid series. It appears that the absence of grooves (or reduced to a trace) and long grooves are both derived conditions, and these have arisen repeatedly.

(3) Antenna: 10-segmented [11-segmented]. Eleven-segmented antennae are plesiomorphic for Coleoptera, occur in the Biphyllidae and Byturidae, and represent the ground plan for all families of the cerylonid series except Discolomidae and Sphaerosomatidae. Ten-segmented antennae have also evolved within *Chileolobius (C. chilensis).*

(4) Labrum with apical edge: truncate [rounded]. Both states occur within the cerylonid series; the polarity of this character is uncertain.

(5) Labral rods: absent [slender]. Both of these states occur throughout the cerylonid series, in addition to broad, club-like labral rods. We suggest that the slender condition is plesiomorphic and labral rods have repeatedly been lost or enlarged. The polarity of this character is uncertain.

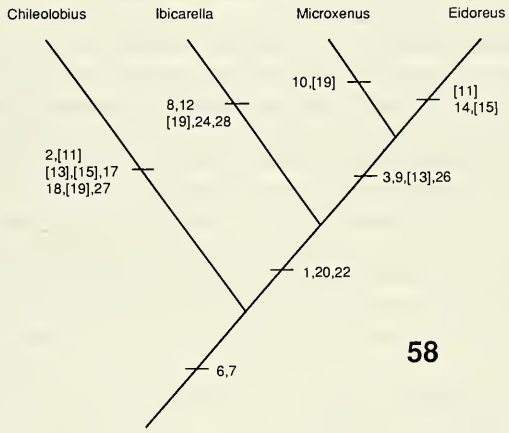
(6) Tormae with mesal arms: recurved, pointing anteriorly [perpendicular or convergent, pointing posteriorly]. Recurved mesal arms of the tormae are only known in Eupsilobiinae and some cerylonine Cerylonidae with highly developed piercing mouthparts.

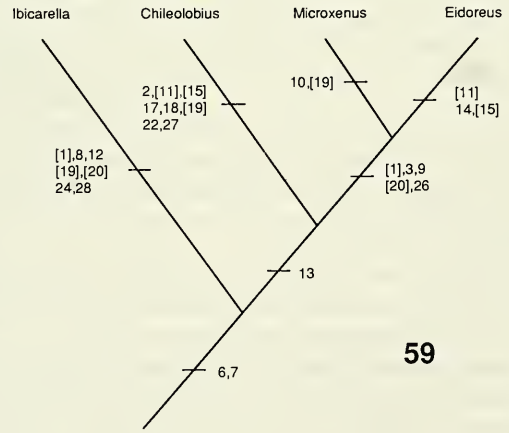
(7) Tentorium with anterior arms: meeting [separate]. The anterior arms are separate in Biphyllidae, Byturidae, and all groups in the cerylonid series except ostomopsine

Cerylonidae, Corylophidae, and most Endomychidae. The apomorphic condition has almost certainly evolved more than once in the cerylonid series.

(8) Tentorium with posterior arms: fused with posterior bridge [separate from posterior bridge]. This appears to be unique to *Ibicarella,* although a similar condition occurs in some bothriderine Bothrideridae.

(9) Tentorium with posterior bridge: lyriform [straight or weakly curved]. The distribution of a lyriform posterior bridge in the cerylonid series is uncertain. We have not, however, recorded it from any other members of the cerylonid series; it appears to be unique to *Microxenus* and *Eidoreus.*





FIGS 58, 59.

Alternative phylogenies of eupsilobiine genera. Numbers refer to characters listed in text, and apparent homoplasies are in brackets.

(10) Pronotum with sulci: present [absent]. Many groups in the cerylonid series and the Biphyllidae have paired pits or submarginal carinae on the pronotum. Otherwise, well-developed sulci are restricted to Endomychidae and a single species of Cerylonidae. Within Endomychidae this character varies greatly in the Mycetaeinae and Mychotheninae, while virtually all of the "higher" endomychids have these sulci present. A notable exception is the Indo-Pacific genus *Cyclotoma* Mulsant.

(11) Hypomeron: modified to receive antenna [unmodified]. The hypomeron is unmodified in Biphyllidae, Byturidae, and virtually all members of the cerylonid series. Distinct antennal cavities are present in murmidiine and some cerylonine Cerylonidae.

(12) Prosternum with elongate, narrow, subparallel antennal grooves: present [absent]. This appears in *Ibicarella.* Such grooves are not present in primitive members of the cerylonid series that we examined.

(13) Prosternum with anterior edge: rounded [straight]. Most of the primitive groups in the cerylonid series, in addition to Byturidae and Biphyllidae, have the plesiomorphic condition. Such diverse endomychids as *Austroclemmus* Strohecker, *Catapotia* Thomson, *Endocoelus* Gorham, and *Periptycus* Blackburn have the anterior edge of the pronotum either rounded or slightly projecting medially; all of these genera, however, have the medial portion of the prosternum distinctly raised from the lateral portions of the prosternum. Other members of the cerylonid series, such as the cerylonids *Angolon* Dajoz, *Axiocerylon* Grouvelle, *Lapethus* Casey, *Murmidius* Leach, and *Thyroderus* Sharp, have the anterior portion of the prosternum raised as a distinct plate that protects the head when retracted.

(14) Prosternum with anterior edge: emarginate medially [entire]. The polarity of this character was determined by functional outgroup comparison using *Chileolobius* as the outgroup.

(15) Mesosternal anterior projection: present [absent]. The projection occurs in *Eidoreus* and *Chileolobius.*

(16) Metasternum with femoral lines: present [absent]. The distribution of femoral lines in the Clavicornia is enigmatic. The polarity of this character is uncertain.

(17) Elytra along suture: partially fused [unfused]. Fused elytra are almost always associated with loss of wings, xeric conditions, or both. In addition to *Chileolobius, Ibicarella* also has wings that are vestigial or absent but without partially fused elytra. This character can be polarized by functional outgroup comparison with the preferred phylogeny (Fig. 57) and one of the alternative phylogenies (Fig. 59).

(18) Elytra with humeri: concave to receive posterior angles of prothorax [convex or flat]. Within Eupsilobiinae this is unique to *Chileolobius* and can be polarized as character 17. A notable similarity is in an undescribed cerylonine from South America and the euxestine *Bradycycloxenus* Arrow.

(19) Tibial spur formula: 0-0-0 [2-2-2]. A formula of 2-2-2 is plesiomorphic for Coleoptera. Many different combinations appear within the cerylonid series, the Byturidae are 2-2-2, and the Biphyllidae are primitively 2-2-2.

(20) Trochanterofemoral attachment: heteromeroid [normal]. As the name implies, heteromeroid trochanters are widespread in the Heteromera. The attachment is weakly heteromeroid in *Ibicarella, Eidoreus,* and *Microxenus.* Weakly heteromeroid trochanters are also present in euxestine and some cerylonine Cerylonidae and most Corylophidae. *Chileolobius* has strongly heteromeroid trochanters. Byturidae, Biphyllidae, and Bothrideridae have strongly heteromeroid trochanters, while all other members of the cerylonid series have the trochanterofemoral attachment weakly heteromeroid or oblique. The polarity of this character is uncertain and depends upon the outgroup selected. We

do not believe that Eupsilobiinae is closely related to Bothrideridae, so we have chosen to interpret the strongly heteromeroid trochanters as derived within the subfamily.

(21) First ventrite with femoral lines: present [absent]. Femoral lines are present in Biphyllidae, Coccinellidae, corylophodine and primitive Corylophidae (see Pakaluk and Lawrence, 1986), some Bothrideridae, many Cerylonidae, and a few Endomychidae, e.g., *Austroclemmus, Displotera,* and an undescribed neotropical genus of Mychotheninae. The presence of femoral lines may not be the ground plan for Eupsilobiinae. Rather, it may unite eupsilobiines with its sister group. As the above discussion suggests, the polarity of this character is uncertain.

(22) Number of ventrites present: five [six]. Five ventrites are present in Byturidae and Biphyllidae, while both states are present in many of the families of the cerylonid series. When both states are present, it appears that six ventrites are present in the primitive members of these families, as illustrated by sticholotidine Coccinellidae. Conversely, all Corylophidae have six ventrites, except for an undescribed genus from Tasmania that has five ventrites; this genus appears to represent one of the most basal lineages within the family (J. Pakaluk, unpublished data). From these data, the direction of the transformation within the cerylonid series, as well as the number of times it has evolved, is uncertain. If the phylogenies depicted in figures 57 or 59 are used, this character can be polarized by functional outgroup comparison.

(23) Ventrites with internal apodemes: present [absent]. Internal apodemes are absent in Byturidae and Biphyllidae. Within the cerylonid series they are present in all Bothrideridae, Cerylonidae, Discolomidae, Sphaerosomatidae, as well as eupsilobiine, mychothenine, holoparamecine, and merophysiine Endomychidae. For the remaining families, Corylophidae, Lathridiidae, Coccinellidae, and other Endomychidae, these apodemes are occasionally present, but the vast majority of genera lack these structures. As with character 21, this feature may not be ancestral for Eupsilobiinae but unite it with other groups. It is not clear if this character has evolved repeatedly or if it is plesiomorphic for the cerylonid series and has been lost many times.

(24) Ventrites with internal apodemes on segments: 2-4 [2-5]. Based upon examination of other taxa in the cerylonid series, the reduction is presumed to be apomorphic. If one alternative phylogeny is accepted (Fig. 58), this character can be polarized by functional outgroup comparison.

(25) Aedeagus with parameres: absent [present]. Reduction or loss of parameres has occurred many times. Parameres are absent in some Biphyllidae, many Cerylonidae, many Endomychidae, Corylophidae, and Lathridiidae.

(26) Aedeagus with median lobe: coiled [curved]. A highly coiled median lobe is rare within the cerylonid series, although a comparable type occurs in the endomychid *Afralexia* Strohecker and a few Cerylonidae. This character can be polarized by functional outgroup comparison with all of the trees presented.

(27) Aedeagus with tegminal strut: fixed [articulated]. This character can be polarized, for two phylogenies (Figs 57 & 59), by functional outgroup comparison. The strut is articulated in most Bothrideridae, Biphyllidae, Byturidae, and ostomopsine Cerylonidae.

(28) Aedeagus with tegminal strut: absent [present]. A tegminal strut is present in Byturidae, Biphyllidae, Lathridiidae, Coccinellidae, Bothrideridae, and some Cerylonidae. The strut has probably been lost several times in the cerylonid series.

In the following discussion of the preferred (Fig. 57) and alternative phylogenies (Figs 58 & 59), numbers refer to the apomorphic states of the characters listed above. The

exceptions are characters 1 and 20 (for Figs 58 & 59) and character 22 (for Fig. 58). In the subsequent discussion of these characters the polarities are reversed, so that the apomorphic states are in brackets. For the alternative phylogenies (Figs 58 & 59), some characters are deleted due to uncertain polarities. In these instances, the numbers that refer to particular conditions have not been changed to make comparisons between trees easier. Thus, figures 58 and 59 have a character 26, for example, on the internode supporting the *Microxenus-Eidoreus* clade, although there are only 22 characters in these analyses.

The preferred phylogeny (Fig. 57) has 28 characters, as listed above, with a length of 33 steps and a Consistency Index of 0.85. Homoplasious characters are 11, 15, 19, and 25. Characters 11, 15, and 19 are convergent on all three phylogenies, with a Consistency Index of 0.50 (11, 15) and 0.33 (19).

An alternative phylogeny (Fig. 58) relies upon a strict application of the outgroup method for polarizing characters. Thus, characters 4, 5, 16, 21, 23, and 25 are deleted since both states occur in the outgroup (here selected as the Byturidae-Biphyllidae lineage), and the polarities of characters 1, 20, and 22 are reversed. This analysis has 22 characters, with a length of 27 steps (this translates to 26 steps on the preferred phylogeny (Fig. 57) if the same characters are deleted, since all of them exept character 25 are completely consistent) and a Consistency Index of 0.81. As with the preferred phylogeny (Fig. 57), characters 11, 15, and 19 are homoplasious (still with seven steps for these three characters) and character 25 was deleted. An additional homoplasy is character 13 with a consistency of 0.50.

Yet another alternative phylogeny (Fig. 59) is one step longer than figure 58 if character 22, number of ventrites, is restored to the polarity used for the preferred phylogeny (Fig. 57). This seems reasonable since this reduction in number of ventrites, which is similar to the reduction in number of antennal segments, has occurred repeatedly in Coleoptera. Here the number of characters is still 22, with a length of 28 steps, and Consistency Index of 0.79. Character 13, however, is restored to be completely consistent, while the new homoplasies are characters 1 and 20, each with a consistency of 0.50.

Regardless of the hypothesis of relationships that is accepted, *Microxenus* and *Eidoreus* consistently are supported as sister groups. We prefer the phylogeny presented in figure 57 for several reasons, including: the general discussion of character evolution in the cerylonid series presented under the section describing characters; it is the shortest (most parsimonious) tree; of the homoplasies not shared by all three trees, it seems most reasonable to us that the loss of parameres could have evolved twice within the Eupsilobiinae, rather than the multiple evolution of character 13 or characters 1 and 20, suggested by the alternative phylogenies (Figs 58 & 59).

It is clear from this analysis that our understanding of the evolution of the cerylonid series of Clavicornia is poor and that this group needs considerably more study before its members may be grouped into a natural classification, recognizing monophyletic groups only. We hope that this preliminary outline of some useful characters in the cerylonid series, here applied to the Eupsilobiinae, is an initial step toward a comprehensive understanding of this enigmatic group of beetles. These conclusions are necessarily tentative, until a more intimate and detailed knowledge of the clavicorns is available. As work in progress by us and others reaches fruition, we hope that it will not only allow us to test the hypotheses proposed here, but to clarify the relationships of the Clavicornia in general.

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